(54) Title: METHOD FOR ASSIGNING AN ID TO AN OBJECT IN A DATABASE
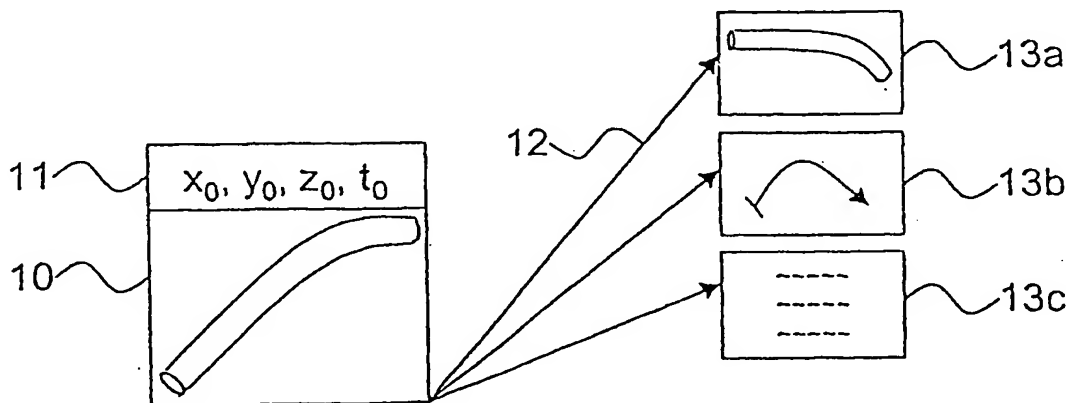
(57) Abstract: The invention relates to a method for assigning an identity to an object (10) in a database, which object has an extension that includes a plurality of coordinate points in a coordinate system representing a multidimensional reality. The method is characterised by the steps of selecting one of the object's coordinate points (P_0) and assigning the object an identity (11) based on the coordinates (x_0, y_0, z_0, t_0) of said coordinate point. Selecting the dimensions of the coordinate system in a suitable manner, e.g. by allowing them to comprise time, space and alternative embodiments, ensures that all objects in the database have wholly unique identities that are also based on one of the coordinate points of the object. This can be used to advantage in the database structure.

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METHOD FOR ASSIGNING AN ID TO AN OBJECT IN A DATABASE

Technical Field

The present invention relates to a method for assigning an identity to an object in a database, which object represents an extension that includes a plurality
5   of coordinate points in a coordinate system representing a multidimensional reality.

Background Art

Various forms of databases for storing information
10   exist very often in our increasingly computerised world. Information is usually structured in the database in the form of objects which, for instance, may represent a physical article whose properties are stored in the database.
15   When transferring the physical reality to a database, software comprising a graphical interface is often used, models being drawn into a coordinate system and stored in the database by the software. This is called "writing" or "entering" the model into the database. One
20   or more models are linked to an object, which may also be linked to information about the properties, choice of material, etc. of the object. The geometric models and other properties are stored in documents that are linked to an object by means of references to an object ID. This
25   type of system is well known in CAD (Computer Aided Design), for instance. The information in the database is used in calculations performed by the designer, such as strength calculations, optimisation calculations, collision analyses, etc.
30   Each object is thus assigned an identity (object ID) in the database, to which object ID the software associates all information (all documents) that relates to this object. Sometimes the identity of the user is stat-

ed, but it is more usual for the object to be automatically assigned an ID by the software, possibly in accordance with specified rules.

One problem is that no uniform method exists for assigning object IDs. Usually the object ID is the same as a product number for a physical product, and every manufacturer has its own principles for numbering its products. This means that most databases are incompatible with each other.

Furthermore, a product number is not unique but may be shared by a large number of identical components. Consider, for instance, a screw of a certain type, with a specific product number, which is used as object ID in a database. Let us assume that the screw occurs 100 times in a construction that is stored in the database. Every time the screw appears it will then have the same ID, which means that there is no satisfactory way of distinguishing between the screws.

One way of dealing with this problem is to connect the product number of the screw to a plurality of positions. However, there is still no way of connecting a document to a specific occurrence of an object since the connection between document and object is based on the ID of the object.

Object of the Invention

One object of the present invention is to provide an improved database for handling objects.

A second object of the invention is to provide a method for assigning an object ID which facilitates the creation of an improved database structure.

A third object of the invention is to provide a substantially automatic method for standardised assignment of unique object IDs.

A fourth object of the invention is to provide a method for assigning object IDs that will facilitate searching in the database.

A fifth object of the invention is to achieve compatibility between databases.

Summary of the Invention

5   The present invention relates to a method for assigning an identity to an object in a database, which object has an extension that includes a plurality of coordinate points in a coordinate system representing a multidimensional reality, which method is characterised

10   by the steps of selecting one of the object's coordinate points and assigning the object an identity based on said coordinate point.

That the object identity is based on a coordinate point in accordance with the invention means that each

15   object is assigned an object ID that explicitly or implicitly provides information as to the position of the object in the coordinate system, or at least one of the object's coordinate points.

Thus, when a component is entered at several places

20   in the coordinate system, each occurrence of the component is assigned a unique object ID and a new object is entered into the database.

The connection between each object ID and a coordinate can be utilised in the structure of the database to

25   achieve faster data processing. The objects can be sorted, for instance, in accordance with the coordinates related to the object IDs, so that the structure becomes easier to search.

In large systems it is normal for a database to be

30   divided into a large number of units which may be located in a plurality of physical storage units, e.g. computer discs. Assigning object IDs in accordance with the invention then enables the coordinate information of each object to determine in which unit it shall occur. This

35   structuring ensures that objects located close to each other in the coordinate system are also in all likelihood stored in the same unit.

One advantage of this is that objects located near each other can be found more quickly in the database. Another advantage of this type of structure is that it becomes possible to easily discover which objects are
5   located in a particular area of a factory, for instance.

According to known technology, in which the object ID is a serial number containing no information, it is considerably more difficult to achieve such a division of database objects.

10   In a preferred embodiment of the invention the coordinate point is selected in a predetermined manner, that follows specific rules and is common to all objects. This ensures consistency in the database. Thus, all that is required to determine the extension of the object in the
15   coordinate system is information as to the object ID, the point-based model describing the object and possibly a transformation matrix.

The step of selecting a point may then comprise the steps of identifying a first subset of coordinate points
20   having an extreme value in one of the dimensions of the coordinate system; if said subset comprises more than one coordinate point, further identifying from said subset a second subset of object points having an extreme value in a second of the dimensions of the coordinate system, and
25   repeating the preceding steps until a subset consisting of a single coordinate point has been identified.

It is normally sufficient to perform the selection in a suitably chosen dimension. However, several points with the same extreme value in one dimension may occur,
30   and further selection may then be required.

The dimensions of the coordinate system are selected so that only one object occurs at each coordinate point, thus ensuring that a unique object ID is linked to each object. The dimensions preferably comprise the three spa-
35   tial dimensions, the time dimension and some abstract dimension, e.g. to permit several alternative embodi-ments.

When one of the dimensions of the coordinate system
consists of time, two object IDs may include identical
spatial coordinates but different time coordinates. This
enables an object to be replaced by a new object in the
5   three-dimensional space, for instance, without the old
object having to disappear from the database. Instead,
the two objects with IDs based on the same spatial coor-
dinates but with different time coordinates can coexist.

In accordance with one embodiment of the invention
10   the object identity is based on information as to when
the object was entered into the coordinate system.
Similarly, the identity may be based, if relevant, on
information as to when the object ceases to be valid.

A consequence of this is that a new object ID is
15   immediately created when an object is moved in the coor-
dinate system or changed in some other way. When this
occurs, the software considers this as two events,
namely:

- The existing object ceases to be valid, whereupon
20   the time information relating to its object ID is extend-
ed to include information as to when the object ceased to
be valid,

- A new object ID is created based on the new
object. The ID of the new object is based on one of the
25   spatial coordinate points of the object and time infor-
mation specifying when the object was entered into the
database.

One application of the invention is when the object
is linked to a model drawn into a graphically represented
30   coordinate system.

In accordance with one embodiment of the invention,
each object represents a physical article, and particu-
larly the geometric extension of this article. This is
the case with CAD, for instance. In accordance with the
35   invention each object ID then automatically relates a
database object to a coordinate point comprising spatial
coordinates and a time coordinate.

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In accordance with one embodiment of the invention the ID of the object is linked to a time interval that specifies when the article exists in the reality represented by the coordinate system, i.e. the active time of

5   the article.

When the time interval extends into the future the identity may be based on an index which permits the occurrence of several objects representing alternative future embodiments of the physical reality represented,

10   which objects may have an overlapping extension in the coordinate system relating to time and space. The various alternatives may be considered as yet another dimension of the coordinate system.

This means that several units can coexist in the

15   same place in the coordinate system relating to time and space, provided they are different alternative embodiments and thus have different indexes. An object need not therefore necessarily cease to be valid when it is changed or moved. Instead it may constitute an alternative to

20   the new object, these two objects being assigned different indexes.

Brief Description of the Drawings

The present invention will be described in more

25   detail in the following with reference to the accompanying drawings illustrating preferred embodiments of the invention by way of example.

Fig. 1 illustrates schematically an environment in which the method in accordance with the invention may be

30   used.

Fig. 2 shows the form of an object ID, and how this is linked to descriptive documents.

Fig. 3 shows a flow chart illustrating the method in accordance with the invention.

35   Fig. 4 shows a flow chart over an example of a method of selection in accordance with the invention.

Fig. 5 shows how an object is moved in a coordinate system.

Fig. 6a shows possible handling of an object ID in connection with the object being moved in accordance with Fig. 5.

Fig. 6b shows a second possible handling of the object ID in connection with the object being moved in accordance with Fig. 5.

Fig. 7 shows how an object is copied in a coordinate system.

Fig. 8 shows the handling of an object ID in connection with copying in accordance with Fig. 7.

Description of a Preferred Embodiment

The method in accordance with the invention is applied in a computer environment comprising a database 1 with a plurality of objects 2. Each object is linked (e.g. by pointers) to one or more documents 3 describing the object. First software 4 to handle the objects in the database and second software 5 comprising a user interface are also shown. Said first and second software units may naturally be integrated in a software unit 6 and will be referred to generally in the following as the "software" 6.

The method in accordance with the invention is intended to be implemented in the software 6 or in separate software cooperating with one or more databases.

The software 6 permits a user to create, edit and remove objects 2, and continuously handles the database in accordance with the changes and in accordance with a specific structure. The software 6 is also arranged, for instance, to be able to perform searches in the database and handle relations between objects. An environment of this type occurs in a multitude of applications, such as CAD or the global database called WWW.

To assign a database object 2 an identity in accordance with the invention, the object is related to a

defined coordinate system having several dimensions, and
one of the object's coordinate points is selected, pre-
ferably in predetermined manner. The identity comprises
the coordinates for this point.

5   The dimensions preferably constitute the three spa-
tial dimensions, time, and an abstract dimension e.g. to
describe alternative embodiments of a component or pro-
cess. The method of assigning an ID to the object is
illustrated in this case in Figs 2-3.

10   When an object is entered into the database it is
linked to a graphic model created previously, possibly
via a transformation matrix defining how the object is
oriented in relation to the graphic model. This model,
drawn in a CAD program, for instance, is suitably con-
15   verted to point-based form, so-called tessellated form.
The object then comprises the existence of a point-based
model in a coordinate system and it can be said that the
object has an extension in the coordinate system.

       Fig. 2 illustrates schematically how the object 10
20   is linked by pointers 12 to one or more documents 13,
that is to say, to the information describing the object
10. A document 13a may include the tessellated model men-
tioned above, a second document 13b may contain a trans-
formation matrix, and a third document 13c may describe
25   the material properties of the object.

       The step of linking an object to a model is desig-
nated 31 in Fig. 3. Thereafter one of the spatial coor-
dinate points of the object is selected in step 32, time
information indicating, for instance, when the object was
30   entered into the database is determined in step 33 and,
if relevant, an alternative index for the object 10 is
determined in step 34. In step 35 the object 10 is then
assigned an ID 11 based on these coordinates.

       The object ID is formed on the basis of the coordi-
35   nates for the selected coordinate point. In the simplest
case the coordinates may simply be allowed to be included
explicitly in the object ID 11, for instance in the form

x, y, z, t_0, i. Another possibility is for the coordinates to be included in an implicit manner. However, it is important that a one-to-one mapping exists between ID and coordinate point, and that this coordinate point is

5   wholly unique. This relationship is utilised in the structure of the database.

When two alternative objects are entered into the database it is advisable to be able to distinguish between the objects by having them associated with dif-

10   ferent time intervals representing an active time for the object, e.g. a time interval when the object occurs in a production series. If an index i is included in the object ID, this is related to an active time for the object. It is naturally possible instead to have the

15   active time interval replace the index i in the object ID. The identity of the object will then be in the form x, y, z, t_0, T_0, T_1.

The following is a more detailed description of how the choice of coordinates can be performed, as well as

20   what the coordinates represent.

One way of determining one of the spatial coordinates of the object is to search the number of points in the point-based model, as it has been placed in the coordinate system, in order to isolate an object point

25   representing an extreme value.

The routine illustrated in Fig. 4 achieves this by considering one dimension at a time. First the coordinate points that have an extreme value in one dimension are determined in step 41 and then a check is made in step 42

30   to see whether more than one point has been encountered. If so, the program check returns to step 41 in order to decide which of these coordinate points has or have an extreme value in a second dimension, whereupon step 42 is repeated. When the loop 41-42 has been run through a

35   sufficient number of times, a single point will have been isolated and this is chosen in step 43 as the coordinate point on which the object ID is to be based.

10

In the case of three spatial dimensions, represented
by x-, y- and z-directions, the procedure could be per-
formed as follows: A subset of coordinate points for
which the x-coordinate is least is selected first. There-
5   after the points for which the y-coordinate is least, are
selected from these points. Finally the point for which
the z-coordinate is least is selected from these points.
It is of course possible, even probable, that a single
point is isolated at the first selection. The following
10   selections may then be omitted. The important thing is
for the procedure to isolate one point from the many
points in the geometric model, and that this point is
selected in accordance with predetermined principles. A
procedure in accordance with the above is simple for one
15   skilled in the art to program.

Naturally the choice of a coordinate point can be
performed even without the model being converted to
tessellated form, but there is then a risk of the pro-
cess becoming more complicated.

20   According to the embodiment described here the
object ID as above also includes a time coordinate con-
sisting of the time when the object was entered into the
database. It may also be advisable, if relevant, for the
object to be linked to a second time coordinate indicat-
25   ing when the object ceased to be valid. However, this
time coordinate need not necessarily be included in the
object ID but may constitute a property of the object.

Finally, if relevant, the identity includes an index
representing alternative objects. This index enables
30   several objects with overlapping extension in time and
space to be present in the database. The various objects
may then be assigned different indexes and at the same
time be associated with time intervals representing an
active time when the article represented by the object
35   will be used. As long as these intervals do not overlap
there is no conflict in allowing two objects to have

otherwise overlapping extension. They are still unique
since they are not active simultaneously.

Every time an object is changed, due to a change in
design, for instance, or if it is moved, it will be re-
5   entered into the database. The object will therefore
acquire a new birth time and thus a new ID. In the case
of spatial displacement, the new identity will also have
new spatial coordinates.

Every time a user changes an object and re-enters it
10   into the database, therefore, a new object ID is created.
In accordance with the invention the user has two alter-
natives as regards the relationship of the new object to
the old one:

1. The earlier object is provided with a time coor-
15   dinate indicating that the object is no longer
valid, which time coordinate consists of the time
when the new object was entered.

2. The new object is assigned an index distinguish-
ing it from the earlier one, and both objects
20   continue to be valid in the database and repre-
sent alternative future embodiments.

Figs 5-6 illustrate what happens when an object is
moved. When the object is moved the distance a, which
occurs at the time t_1, the point P_0 is moved to point P_1.
25   A new object 15 is thus entered into the database with an
identity 16 comprising the coordinates for the point P_1
and the time t_1. The new object may be linked to the same
documents 13 as the object 10, or may be linked to copies
of these documents. A third alternative is for the object
30   15 to be linked to the object 10 and in effect, there-
fore, it is a copy of this object.

At the same time the user is offered two possibi-
lities, which are described below with reference to
Figs 6a-b.

35   Fig. 6a illustrates the situation when the object
10 ceases to be valid. The object 10 is then linked to a
second time t_1, and retains its ID 11 in the form x_0, y_0,

z_0, t_0. If desired, the time t_1 may be included in the ID 11 of the object 10. The ID 16 of the object 15 comprises the coordinates x_1, y_1, z_1, t_1.

Fig. 6b illustrates the second possibility, namely
5   that both objects remain valid but as different alternatives. An index, e.g. 1, is added to the ID 11' of the earlier object 10 which therefore takes the form x_0, y_0, z_0, t_0, 1. This object 15 is assigned an ID 16' with a different index, e.g. 2, and takes the form x_1, y_1, z_1,
10   t_1, 2. A time interval 17, 18 may also be linked to each object, indicating the period of time during which the object exists in reality.

In practice the above procedure is performed by the user changing a graphic representation of an article in
15   a first stage through the interface, without the database being affected. The user then gives a command to the software for the changes to be transferred to the database, whereupon handling of the object ID and object takes place. The user is also offered the opportunity of
20   choosing between the two different alternatives, depending on whether the object is to cease to be valid or not.

The above procedure is naturally exactly analogous if the object is to be changed in some way other than by being moved, in which case the spatial coordinates (x_0,
25   y_0, z_0) of both the object IDs may be the same. It is naturally also possible for the new object 15 to be linked to other documents than the object 10, for instance if it has been turned in relation to the object 10 and thus has a different transformation matrix, or if the geome-
30   tric model has been changed.

Referring now to Figs 7 and 8 a description will be given of how the database handles the situation when a user copies an object, and thus desires a second appearance of an existing component or article.

35   When the object 10 in Fig. 7 is copied at time t_2 to a new position P_2, a new object 20 is created which is assigned a new, unique ID 21, based on the coordinates in

the point P_2 and the time t_2. This object 20 may either be
linked by pointers 22 to the same descriptive documents
13 as the original object 10 or, preferably, be linked by
a pointer 23 to the ID 11 of the original object 10. Yet
5   another possibility is for the object 10 to be linked to
copies of the documents 13 if this is advantageous.

It is sometimes desirable to create a copy of an
earlier object, but where the new object shall be trans-
formed in some way. The new object 20 may then be link-
10   ed by a pointer 24 to a transformation matrix 25. In a
simple case the transformation is pure mirroring, which
is usual in a design (left or right components).

When several objects are linked together, larger
combined objects are created. According to the invention
15   these are also assigned an object ID in accordance with
the same principles as those described above. This object
ID is connected to the IDs of the component objects by
pointers, and this combined object thus inherits the pro-
perties of the component objects.

20   In the above description of one embodiment of the
invention the objects represent physical articles which
are depicted by a user in a graphic interface. A plura-
lity of CAD programs, known per se, function in this man-
ner. This shall not be seen as a limitation of the inven-
25   tion, which can also be used in other types of databases
such as databases with HTTP documents such as WWW. The
important feature is that each database object has a
unique occurrence in some form of coordinate system and
that this occurrence is utilised when assigning an iden-
30   tity to the object.

In the example described above, the coordinate sys-
tem may also be said to have five dimensions: namely the
three spatial dimensions, time and alternative. However,
the invention shall not be limited to this example and
35   the dimensions of the coordinate system could consist of
an optional combination of dimensions - spatial as well
as abstract.

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The method may be applied, for instance, in a coordinate system comprising only one spatial dimension (x), time and alternative. This coordinate system could be used to describe trains on a railway line. The coordinates of each train are determined by its position along the line, a point in time and, if relevant, an alternative index. For two trains to have the same spatial position in an overlapping time interval they must have different alternative indexes. In reality this corresponds to the railway line having parallel tracks, each representing different alternatives.

A further development of the invention is for an object in a process area in which articles are moved, to be assigned an ID. According to the invention, an object moving in the area may be represented by a plurality of objects, each of which is associated with an extension in the area and a time interval. The extension in the time-space, the "envelope", can then easily be studied by creating several objects by dividing the time interval into smaller intervals.

In a situation where two envelopes collide, such breaking-down or division into several objects may result in it being revealed that the collision does not occur.

CLAIMS

1. A method for assigning an identity to an object
(10) in a database (1), which object has an extension
that includes a plurality of coordinate points in a coor-
dinate system representing a multidimensional reality,
c h a r a c t e r i s e d   b y
selecting one of the object's coordinate points
(P_0), and
assigning the object an identity (11) based on the
coordinates (x_0, y_0, z_0, t_0) of said coordinate point.

2. A method as claimed in claim 1, wherein the step
of selecting a coordinate point (P_0) is performed in a
predetermined manner common to all objects.

3. A method as claimed in claim 2, wherein the step
of selecting a point comprises the steps of
identifying a first subset of coordinate points
having an extreme value in one of the dimensions of the
coordinate system (step 41);
if said subset includes more than one coordinate
point (step 42), further identifying from said subset
a second subset of object points having an extreme value
in a second of the dimensions of the coordinate system
(step 41), and
repeating the preceding steps until a subset con-
sisting of a single coordinate point has been identified.

4. A method as claimed in any one of the preceding
claims, wherein one of dimensions of the coordinate sys-
tem is time.

5. A method as claimed in claim 4, wherein the iden-
tity (11) is based on information as to the time (t_0)
when the object was entered into the coordinate system.

6. A method as claimed in claim 5, wherein the iden-
tity (11) is based, if relevant, on information as to the
time (t_1) when the object ceases to be valid.

7. A method as claimed in any one of the preceding claims, wherein the object is linked to a model drawn into a graphically represented coordinate system.

8. A method as claimed in any one of the preceding
5 claims, wherein the object represents a physical object.

9. A method as claimed in claim 8, further comprising the step of allowing the identity (11) to be linked to a time interval (17, 18) that specifies during which space of time the physical object exists in the reality
10 represented by the coordinate system.

10. A method as claimed in claim 9, further comprising the step of, when the time interval (17, 18) extends into the future, allowing the identity (11) to comprise an index (i) which permits the occurrence of several
15 objects representing alternative future embodiments of the physical reality represented, which objects may have an overlapping extension in the coordinate system relating to time and space.

11. A method as claimed in any one of the preceding
20 claims, wherein the identity (11) explicitly comprises the coordinates of the coordinate point, e.g. in the form k_1, k_2, k_3, k_4 where k_i is the coordinate in dimension i.

AMENDED CLAIMS
[received by the International Bureau on 11 December 2000 (11.12.00);
original claim 1 amended; remaining claims unchanged (2 pages)]

1. A method for assigning an identity to an object
(10) in a database (1), which object has an extension
that includes a plurality of coordinate points in a coor-
dinate system representing a multidimensional reality,
c h a r a c t e r i s e d by
    selecting one of the object's coordinate points
(P_0), and
    assigning the object an identity (11) based on the
coordinates (x_0, y_0, z_0, t_0) of said coordinate point in
such a way that a one-to-one mapping exists between the
identity (11) and the coordinate point (P_0).

2. A method as claimed in claim 1, wherein the step
of selecting a coordinate point (P_0) is performed in a
predetermined manner common to all objects.

3. A method as claimed in claim 2, wherein the step
of selecting a point comprises the steps of
    identifying a first subset of coordinate points
having an extreme value in one of the dimensions of the
coordinate system (step 41);
    if said subset includes more than one coordinate
point (step 42), further identifying from said subset
a second subset of object points having an extreme value
in a second of the dimensions of the coordinate system
(step 41), and
    repeating the preceding steps until a subset con-
sisting of a single coordinate point has been identified.

4. A method as claimed in any one of the preceding
claims, wherein one of dimensions of the coordinate sys-
tem is time.

5. A method as claimed in claim 4, wherein the iden-
tity (11) is based on information as to the time (t_0)
when the object was entered into the coordinate system.

AMENDED SHEET (ARTICLE 19)

6. A method as claimed in claim 5, wherein the identity (11) is based, if relevant, on information as to the time (t_1) when the object ceases to be valid.

7. A method as claimed in any one of the preceding claims, wherein the object is linked to a model drawn into a graphically represented coordinate system.

8. A method as claimed in any one of the preceding claims, wherein the object represents a physical object.

9. A method as claimed in claim 8, further comprising the step of allowing the identity (11) to be linked to a time interval (17, 18) that specifies during which space of time the physical object exists in the reality represented by the coordinate system.

10. A method as claimed in claim 9, further comprising the step of, when the time interval (17, 18) extends into the future, allowing the identity (11) to comprise an index (i) which permits the occurrence of several objects representing alternative future embodiments of the physical reality represented, which objects may have an overlapping extension in the coordinate system relating to time and space.

11. A method as claimed in any one of the preceding claims, wherein the identity (11) explicitly comprises the coordinates of the coordinate point, e.g. in the form k_1, k_2, k_3, k_4 where k_i is the coordinate in dimension i.
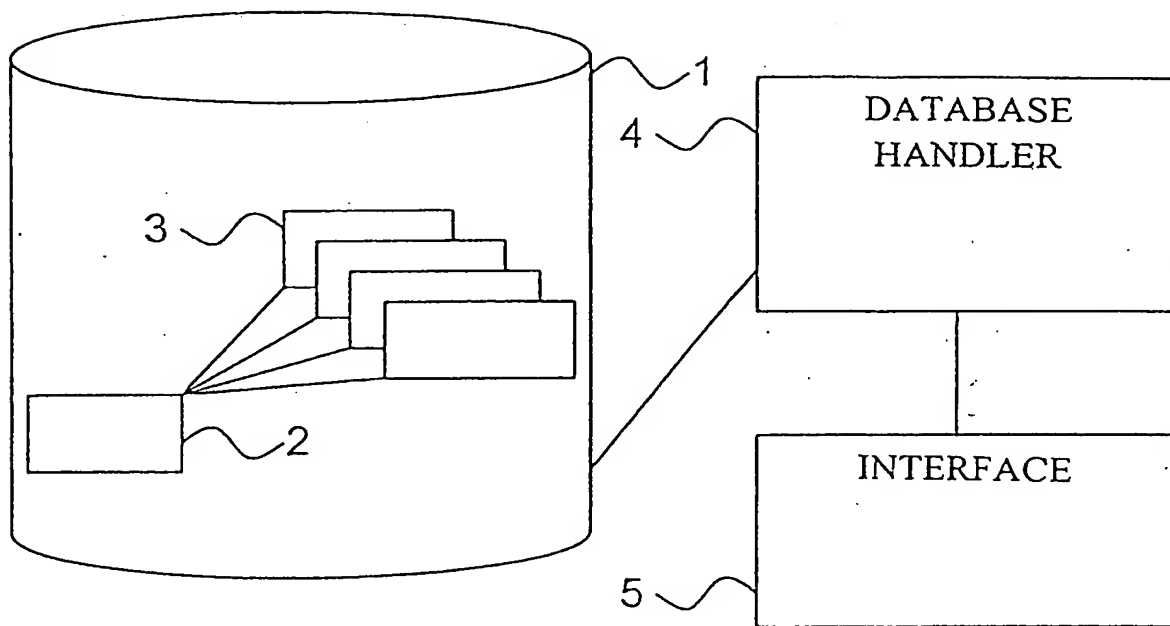
FIG. 1
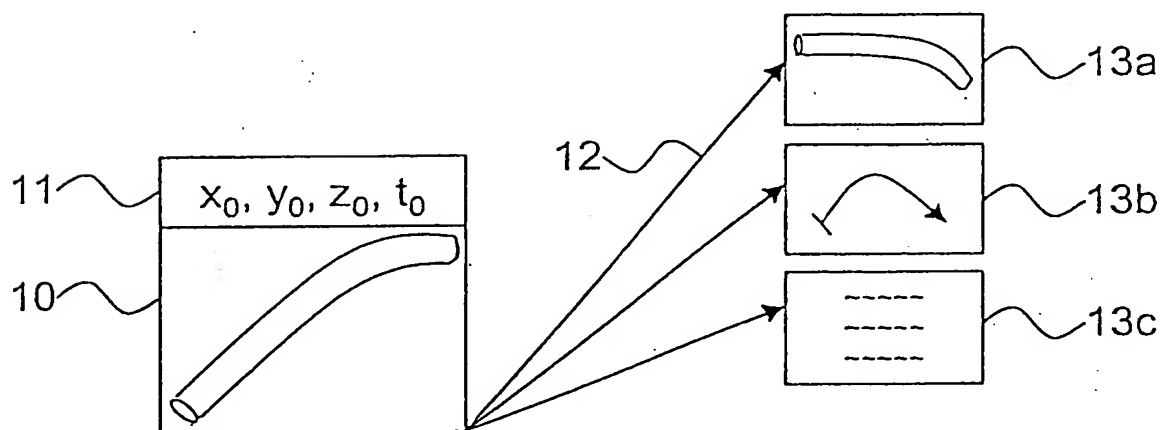

FIG. 2

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LINK OBJECT TO
MODEL   31

SELECT SPATIAL COORDINATE   32

DETERMINE
TIME COORDINATE   33

DETERMINE ALTERNATIVE
INDEX   34

ASSIGN OBJECT
AN OBJECT ID   35
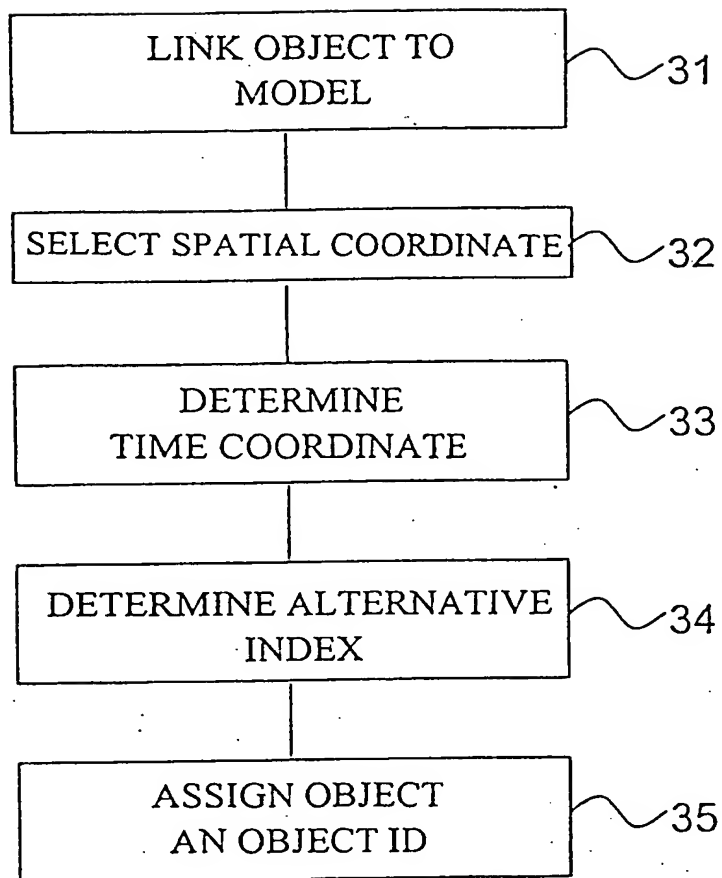
FIG. 3

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                        │
                        │◄──────────────────────┐
                        ▼                        │
        ┌───────────────────────────────┐       │
        │  DETERMINE COORDI-            │        │
        │  NATE POINTS WITH AN          │        │
41 ～   │  EXTREME VALUE IN ONE         │        │
        │  DIMENSION                    │        │
        └───────────────────────────────┘       │
                        │                        │
                        ▼                        │
                    ╱       ╲                    │
                  ╱   MORE    ╲                  │
                ╱   THAN ONE    ╲     YES        │
               ╱   COORDINATE    ╲───────────────┘
       42 ～    ╲    POINT?      ╱
                ╲             ╱
                  ╲        ╱
                    ╲    ╱
                      ╲╱
                    │  NO
                    ▼
        ┌───────────────────────────┐
43 ～   │   SELECT THIS             │
        │   COORDINATE POINT        │
        └───────────────────────────┘
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FIG. 4

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FIG. 5

FIG. 6a

FIG. 6b

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FIG. 7

FIG. 8
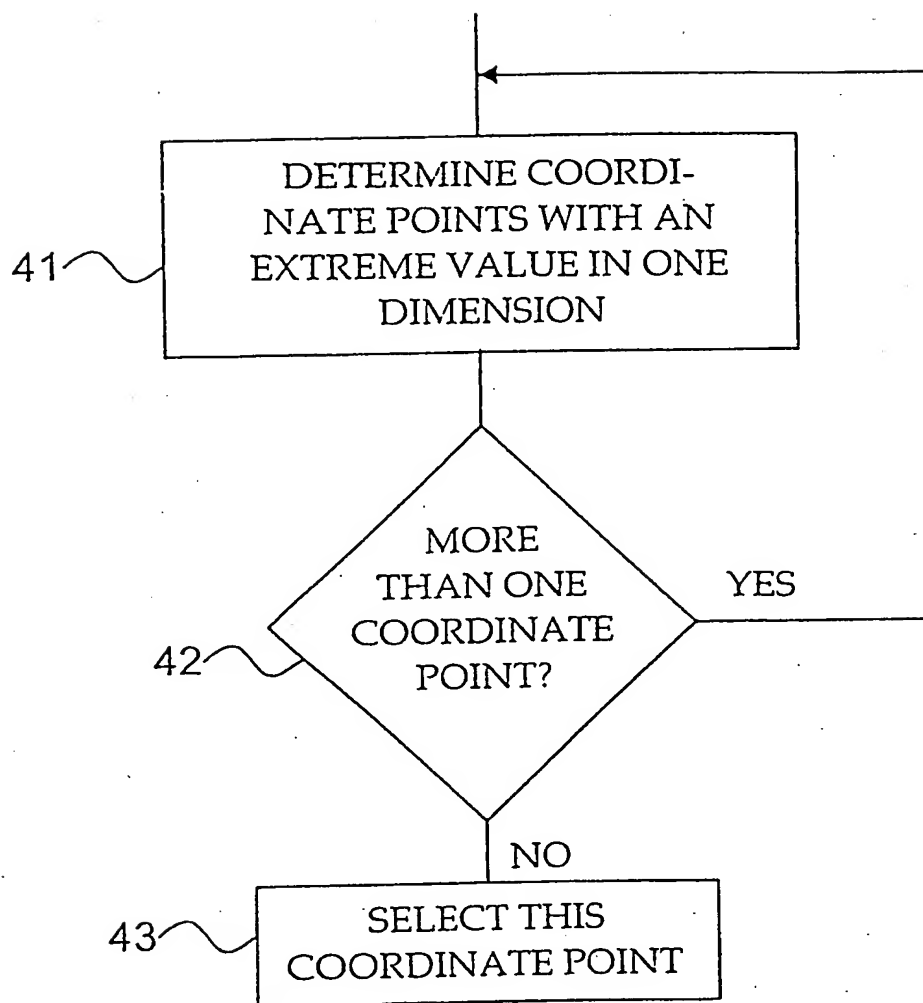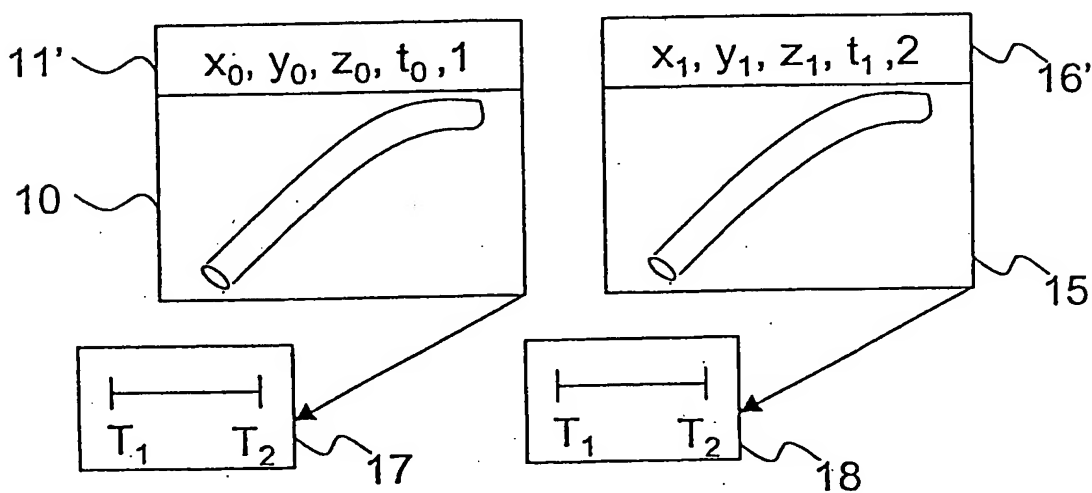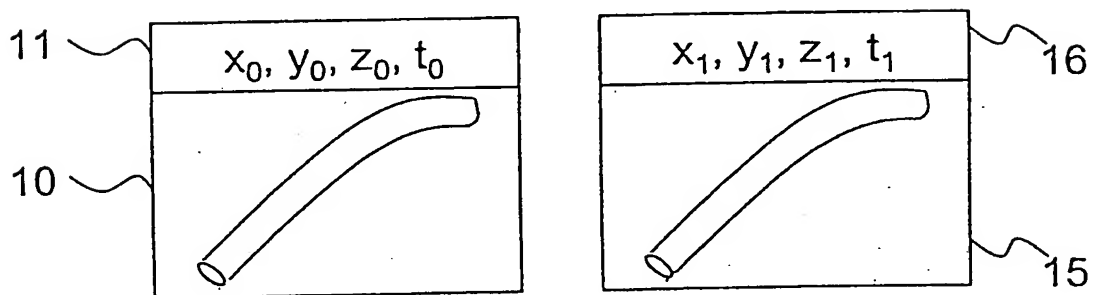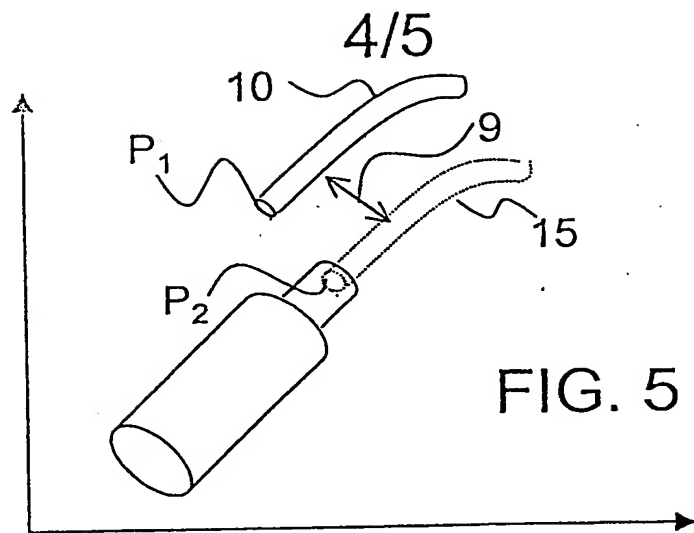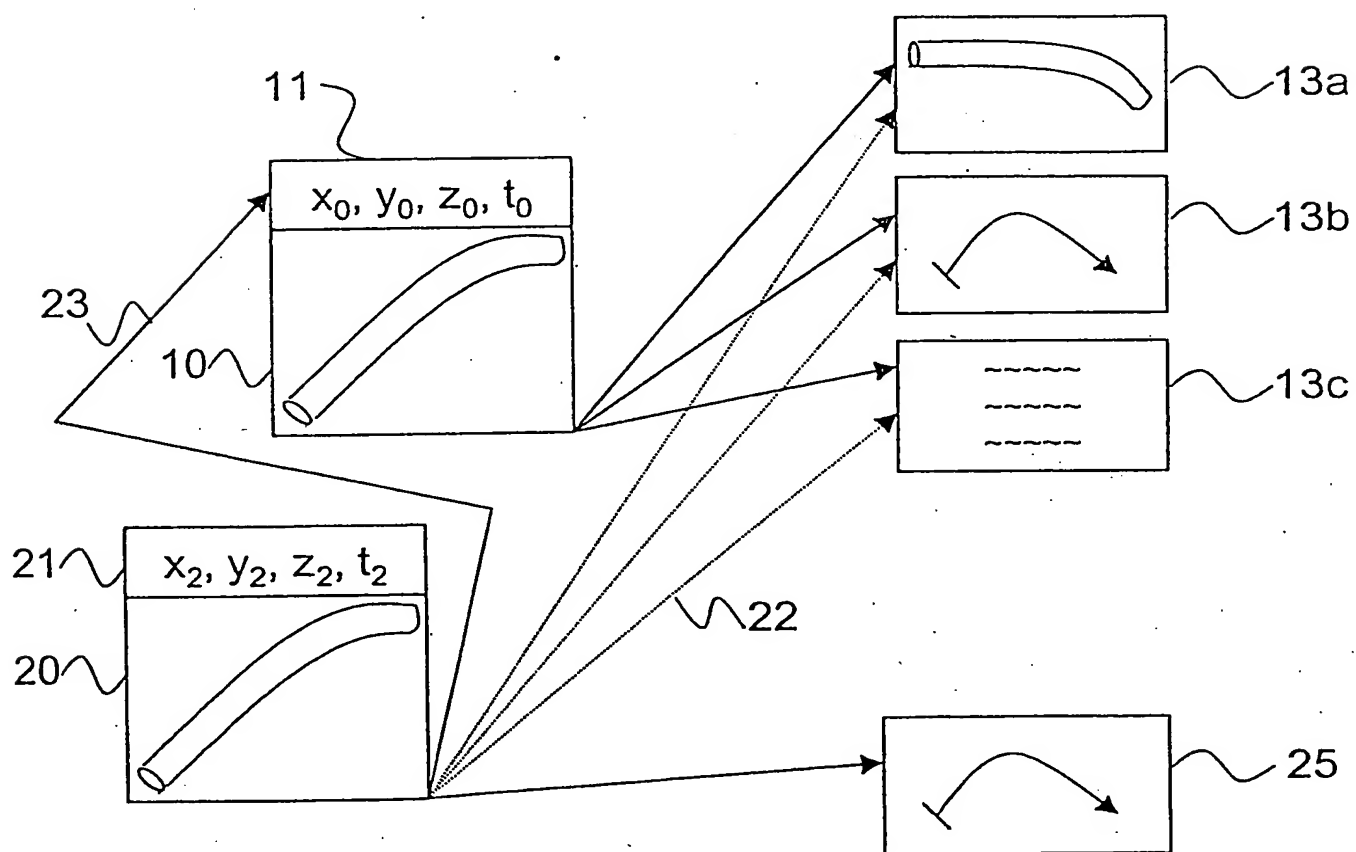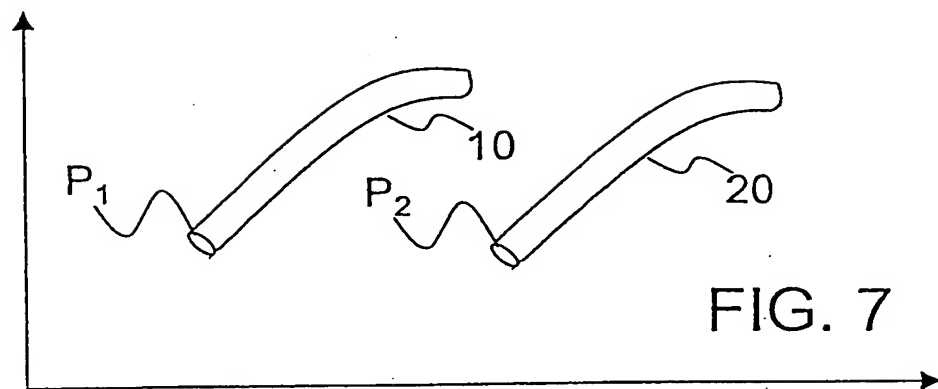
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INTERNATIONAL SEARCH REPORT

International application No.	
PCT/SE 00/01439	

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G06F 17/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9305467 A1 (NIAGARA MOHAWK POWER CORPORATION), 18 March 1993 (18.03.93), see the whole document	1-11
A	US 5652881 A (MASAMITSU TAKAHASHI ET AL), 29 July 1997 (29.07.97), see the whole document	1-11

☐ Further documents are listed in the continuation of Box C.	☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 Sept 2000	2 4 -10- 2000

Name and mailing address of the ISA/	Authorized officer
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Patent document cited in search report			Publication date	Patent family member(s)			Publication date
WO	9305467	A1	18/03/93	AU	2642892	A	05/04/93
				US	5487139	A	23/01/96
US	5652881	A	29/07/97	JP	7146871	A	06/06/95